COMETS 1880, *d* AND *e*.—M. Bigourdan has continued his ephemeris of the comet discovered by Schäberle on April 6, but states from observations made at Paris that the intensity of light has diminished much more rapidly than is due to change of distance from the earth and sun; on September 30 he estimated the comet to be of the same brightness as on May 18; it is still in a favourable position for observation, as will be seen from the following extract from M. Bigourdan's ephemeris for Paris midnight:—

		R.A.			N.P.D.	
		h.	m.	s.	°	′
Oct. 22	...	5	56	3 ...	89	49
24	...	–	50	57 ...	91	4
26	...	–	45	38 ...	92	21
28	...	–	40	6 ...	93	38
Oct. 30	...	5	34	22 ...	94	55
Nov. 1	...	5	28	27 ...	96	12
3	...	5	22	21 ...	97	28
5	...	5	16	6 ...	98	44

The Astronomer-Royal has notified the discovery of another comet by Mr. Lewis Swift of Rochester, N.Y., on the night of October 11, in R.A. 21h. 30m. and Decl. + 18°.

METEOROLOGICAL NOTES

PROF. LOOMIS, in his thirteenth contribution to meteorology, investigates the question of the great and sudden changes of temperature which are so marked a feature in the climates of a large portion of the United States. Six years' observations of the Signal Service stations have been examined, with the result that there are 118 stations at which there has occurred at least one case of a daily range not less than 40°·0. Limiting the inquiry, however, to stations at which the average number of cases amounted to six annually, it is seen that there are thirty-six such stations. The stations where the great fluctuations of temperature occur most frequently are situated south of lat. 35°, in which region the fluctuations of pressure attending the progress of storms are but little felt; and it is to be noted that these great fluctuations of temperature occur most frequently in the summer months. Thus at Wickenburg (lat. 34·0, long. 112°·7), which is situated in a desert sandy region, with an annual rainfall of only 4·99 inches, on ten of the nineteen days ending with August 14, 1877, the temperature showed a daily range of at least 62°·0, reaching in one case to 76°·0. These enormous temperature changes are due to the extreme dryness of the air, by which the sand becomes intensely heated by the sun during the day, whereas by night the loss of heat by radiation is as great as perhaps anywhere on the globe. The general result of the inquiry is that the most remarkable cases are merely examples of the ordinary diurnal change of temperature, unaffected by the passage of storms, whilst the remaining cases, which occur in the higher latitudes of the States, are to be ascribed to the influence of storms along with the ordinary diurnal change of temperature. It also appears from a careful investigation that dry air, even when greatly heated, has but little ascensional force, and that the violent uprising of heated air, so frequently witnessed in moist climates, particularly during thunderstorms, is mainly due to the large amount of aqueous vapour with which it is charged. As regards great fluctuations of temperature in winter, Prof. Loomis points out that while, for example, a temperature of – 20°·0 occurs at Denver on the east side of the Rocky Mountains, an average temperature of 30°·0 prevails in the Salt Lake Basin, and remarks that by the movements of the atmosphere attending the progress of a great storm these contiguous masses of air with temperatures so different from each other are brought successively over the same station, and thus bring about a change of temperature amounting on occasions to 50°·0 in a single hour.

PROF. LOOMIS also carefully investigates the storms, with their characteristic low barometers, which cross the Rocky Mountains, and shows that no great barometric disturbances originate in the Salt Lake Basin; that nearly all the great barometric disturbances experienced in the Salt Lake Basin come from the Pacific, and generally from the north-west; and that nearly all these disturbances can be followed to the Atlantic, meeting it near lat. 47°·0, and occupying from two to six days in the passage, or an average of three and a half days, corresponding to an onward movement of about 700 English miles a day. As has been shown to obtain in other regions of the globe, the isobars which define storms are often not so symmetrical over a mountainous region as over a level country. In not a few cases however the isobars show considerable symmetry over the Rocky Mountains, and this feature becomes the more noticeable in very violent storms. From the observations made at Pike's Peak, 14,200 feet high, as well as at Mount Washington, 6,285 feet, it appears that the winds at great elevations circulate about a low barometer, just as they do near the level of the sea; but the position of this centre at great heights sometimes differs considerably from the low centre prevailing at the surface of the earth, and when such deviation does occur it is generally toward the north-west. Of the thirty-six cases examined, the low centre at great elevation was, in twenty-seven cases, vertical over the low centre at lower levels, in five cases to north-west, in one case to north, in another case to west, and in two cases to east. It must however not be lost sight of that this important point in the phenomena of storms cannot be exactly determined but by a multiplication of high-level stations.

DISPLAYS of auroras appear to have been remarkably frequent in America during August last. In Mr. Carpmael's Weather Report of the month for Canada it is stated that the aurora of the 12th was very brilliant, and was seen at nearly every station from Manitoba to the Atlantic. From the United States Monthly Weather Report we learn that auroras were frequent during the month, occurring on no fewer than twenty-one nights, the auroras of the 12th and 13th being of remarkable brilliancy, as well as widespread. On these nights the aurora was seen at about 100 stations from Maine westward, as far as clear skies allowed its being seen. The more prominent features of these auroras as detailed in the Report are of such interest as to suggest that a more detailed account of them, as seen in the northern hemisphere during the night of August 12 and 13, could not fail to contribute data of the greatest importance in this little-understood branch of physics.

IN the *Journal* of the Scottish Meteorological Society, recently published, there is a paper of some interest, by Mr. Buchan, on the diurnal periods of thunderstorms in Scotland. There are two well-marked types of thunderstorms, the one occurring in the summer months, and having its daily maximum frequency from 1 p.m. to 6 p.m., and the other occurring in the winter months, with its maximum from 9 p.m. to 3 a.m. Stations in the eastern division of the country where the annual rainfall is small, or only of moderate amount, have all, or nearly all, their thunderstorms during the summer months; whereas in the west, or where the climate is wet and the rainfall heavy, a very considerable proportion of the thunderstorms occur during the winter months, and these are nearly always of short duration, and are the accompaniments of the winter cyclones of North-Western Europe. In this connection it is interesting to note that the thunderstorms of Stykhisholm in Iceland are phenomena of the winter months and of the nights, only three being recorded as having happened at a time of the day when the sun was above the horizon. The maximum daily period of the summer thunderstorm coincides with the hours when the ascending columns of heated air from the earth's surface are in full activity, and the result is no doubt largely due to the circumstance that these ascending masses of heated air develop a charge of electricity as their moisture condenses into cloud. The period of maximum frequency of the winter thunderstorm occurs some hours before and after midnight, or during those hours of the day when the land surface presented to the vapour-laden winds of the Atlantic approaches to and reaches its diurnal minimum temperature, and when consequently the condensation of the vapour may be expected to reach its daily maximum. On the other hand, the minimum period in summer occurs during the early morning, the absolute minimum being at the hour just before the ascending columns of heated air are set in motion, and the number remains few till about 11 a.m., or till the tops of the heated columns have risen to some height in the atmospheres.

IN the *Journal* of the Meteorological Society for April and July last are given the results of observations made during the first six months of 1880 at about forty "climatological stations" recently established by the society. At these stations observations are taken only once a day, [viz., at 9 a.m., and are restricted to temperature, cloud, and rain. An extension of these stations which would include the whole of the English sanataria, and which doubtless will gradually be effected, would furnish data for a correct presentation of the comparative climatologies of the health resorts of England.

BIOLOGICAL NOTES

NEST-BUILDING AMPHIPODS.—Mr. S. J. Smith, in a memoir on some amphipods described by Thomas Say (*Trans.*, Connecticut Acad., July, 1880), states that the tubes which certain

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species make to live in are to a great extent formed of pellets of their excreta. In 1874 he watched carefully the process of constructing the tubes in several species of Amphipoda. *Microdeutopus grandimanus* (*M. minax*, Smith) was a particularly favourable subject for observation. When captured and placed in a small zoophyte trough with small branching algæ, the individuals almost always proceeded at once to construct a tube, and could very readily be observed under the microscope. A few slender branches of the alga were pulled toward each other by means of the antennæ and gnathopods, and fastened by threads of cement spun from branch to branch by the first and second pairs of peræopods. The branches were not usually at once brought near enough together to serve as the framework of the tube, but were gradually brought together by pulling them in and fastening them a little at a time, until they were brought into the proper position, where they were firmly held by means of a thick network of fine threads of cement spun from branch to branch. After the tube had assumed very nearly its completed form, it was still usually nothing but a transparent network of cement threads woven among the branches of the alga, though occasionally a branch of the alga was bitten off and added to the framework: but very soon the animal began to work bits of excrement and bits of alga into the net. In this case the pellets of excrement, as passed, were taken in the gnathopods and maxillipeds, and apparently also by the maxillæ and mandibles, and broken into minute fragments and worked through the web, upon the outside of which they seemed to adhere, partially by the viscosity of the cement threads, and partially by the tangle of threads over them. Excrement and bits of alga were thus worked into the wall of the tube until the whole animal was protected from view, while, during the whole process, the spinning of cement over the inside of the tube was kept up. When spinning the cement threads within the tube the animal was held in place on the ventral side by the second pair of gnathopods and the caudal appendages, the latter being curved beneath the anterior portion of the pleon, and on the dorsal side by the third, fourth, and fifth pairs of peræopods extended and turned up over the back, with the dactyli turned outward into the web. The spinning was done wholly with the first and second peræopods, the tips of which were touched from point to point over the inside of the skeleton tube in a way that recalled strongly the movements of the hands in playing upon a piano. The cement adhered at once at the points touched and spun out between them in uniform delicate threads. The threads seemed to harden very quickly after they were spun, and did not seem even from the first to adhere to the animal itself.

DEATH BY HANGING.—Recent experiments regarding the nature of death by hanging or strangulation induce Prof. Tammasia to reject the view that the chief cause of such death is compression of the pneumogastric, causing paralysis of the heart (*Reale Ist. Lomb.*, fasc. xiii.). In the great majority of cases, he says, the proximate cause of death is the occlusion of the respiratory passages. The greater or lesser rapidity of the death depends on the degree of such occlusion. Compression of the pneumogastric and of the vessels of the neck may strengthen the efficacy of that direct cause, but, in the absence of the latter, it is insufficient to cause any instantaneous lethal phenomenon, as some have supposed.

HÆMOGLOBIN IN ECHINODERMS.—The presence of hæmoglobin in the aquiferous system of an Echinoderm (*Ophiactis urens*, one of the Ophiurida) has lately been demonstrated by M. Foottinger (Belgian Acad. *Bull.*, No. 5). The only branches of the metazoa in which it had not before been found were echinoderms and zoophytes. Simroth observed certain globules in the ambulacral canals of the former, but not observing live individuals, he missed the hæmoglobin, which may be observed if one of the arms of the living animal be broken; a drop of red colour appearing presently at the extremity. With the spectroscope the identity of the colouring matter with that of the blood of vertebrates can be easily proved. The hæmoglobin is connected with globules, of varying form and size. Most have a nucleus and are true cells. Along with these are free nuclei and small unnucleated corpuscles charged with hæmoglobin.

AN OPTICAL PROPERTY OF THE CORNEA.—Prof. Fleischl of Vienna has recently examined fresh corneas in polarised light, and found that the corneal fibres became, under tension, doubly refractive, and then occasionally give phenomena similar to those occurring in starch granules (the theory of which has been examined by von Lang). With this condition also is connected the opacity of the cornea on rise of intraocular pressure.

PHOSPHORIC ACID IN THE URINE OF COWS.—It is generally supposed that the urine of herbivora does not contain phosphoric acid. M. Chevron, however, lately had occasion (*Bull. de l'Acad. Roy. de Belg.*, No. 8) to observe phosphates (a combination of potassico-magnesian phosphate with bimagnesic phosphate) in the urine of cows which had been receiving linseed oil-cake ($1\frac{1}{2}$ kil. per head daily), bran ($1\frac{1}{2}$ kil.), beet (25 kil.), and straw ($7\frac{1}{2}$ kil.), a diet which is rich in phosphoric acid (oil-cake and bran) and in potash (beet). The phosphoric acid diminished and disappeared when green clover or lucern was substituted for the beet. It appears from experiments made by Herr Bertram in Leipzig, in 1878, that lime has the property of eliminating phosphoric acid from the urine of herbivora, and M. Chevron points out that the green fodder specified undoubtedly imparted more lime than the beet did. He proposes further experiment, however, to determine exactly the cause of elimination of the acid

RUDIMENTARY COMA IN GODETIA.—While investigating the development of the embryo sac in the different genera of Onagraceæ, writes Mr. John M. Coulter, editor of the *Botanical Gazette*, Indiana (vol. v. Nos. 8 and 9, p. 75), my attention was attracted to certain hair-like projections which appeared upon the forming ovule of Godetia (probably *G. grandiflora*). A careful examination showed them to be identical in structure with the forming hairs in the coma of Epilobium. They occurred almost exclusively at the chalazal end, one or two scattered ones being detected farther down upon the raphe. A study of the development of the coma of Epilobium shows that the first indication of it is a tuberculated appearance of the chalazal end. Presently these tubercles push out into elongating nucleated cells, which eventually develop into the long hairs of the coma. Now Godetia permanently retains this tuberculated margin at the upper end, but does not usually develop its coma any further. In the cases examined, however, the forming ovules (either in reminiscence or prophecy) stretched out their tubercles into incipient hairs. Tracing these ovules in their subsequent development, it was found that these hairs gradually disappeared until, when the ovules had become anatropous, there was no indication of them. As Godetia has been merged into Œnothera, many species of the latter were examined, to see if any such thing occurred in them; but no trace of such growth was detected. This would seem to indicate that if Godetia be not entitled to generic rank, it is at least that part of Œnothera which approaches Epilobium. A discrepancy must, however, be noticed here. In Epilobium the hairs of the coma do not begin to form until the ovule has become completely anatropous; but in the Godetia observed the incipient coma had all disappeared by the time the ovule had become anatropous, beginning to form before the nucleus is half covered by the coats. These hairs appeared in greatest size and abundance when the axis of the ovule was at right angles to its anatropous position.

PHYSICAL NOTES

A BEAUTIFUL illustration of the laws of polarisation of light has lately been made by M. G. Govi. To understand it requires a somewhat careful explanation. Let a parallel beam of light be passed through a polariser, then through a thin slice of quartz cut perpendicularly to the optic axis, then through an analysing Nicol prism. It is seen, as is well known, to be coloured. This coloured light when passed into a spectroscope gives a spectrum marked by one or more dark bands, corresponding to the particular rays whose relative retardations in passing through the crystal slice have produced interference. These bands are not always in one place; they are displaced right or left (according to whether the crystal is a right-handed or a left-handed specimen) if either the analyser or the polariser be rotated. A slice of quartz about 4·3 millims. thick produces a single band. One of 8·6 millims. two bands at once in the visible spectrum, the number of bands being proportional to the thickness of the crystal. Now suppose a mechanical contrivance by which both the analyser and the spectrum can be rotated at the same velocity. A direct-vision prism attached to the front of the Nicol prism realises the optical portion of this combination. There will be seen on rotation a circular spectrum, having either red or violet at the centre and either violet or red at its outer circumference. Now since the dark band spoken of is displaced by a quantity proportional to the amount of rotation, interference will take place in this circular spectrum along points which form geometrically a spiral of Archimedes. The persistence of impressions on the retina will enable this dark spiral to be seen in its entirety,

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